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Tanaka

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[54] **BUCKLE APPARATUS**

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[51] **Int. Cl.**[5] **A44B 11/25**
[52] **U.S. Cl.** **24/641**; 24/633
[58] **Field of Search** 24/633, 641, 637, 640, 24/645

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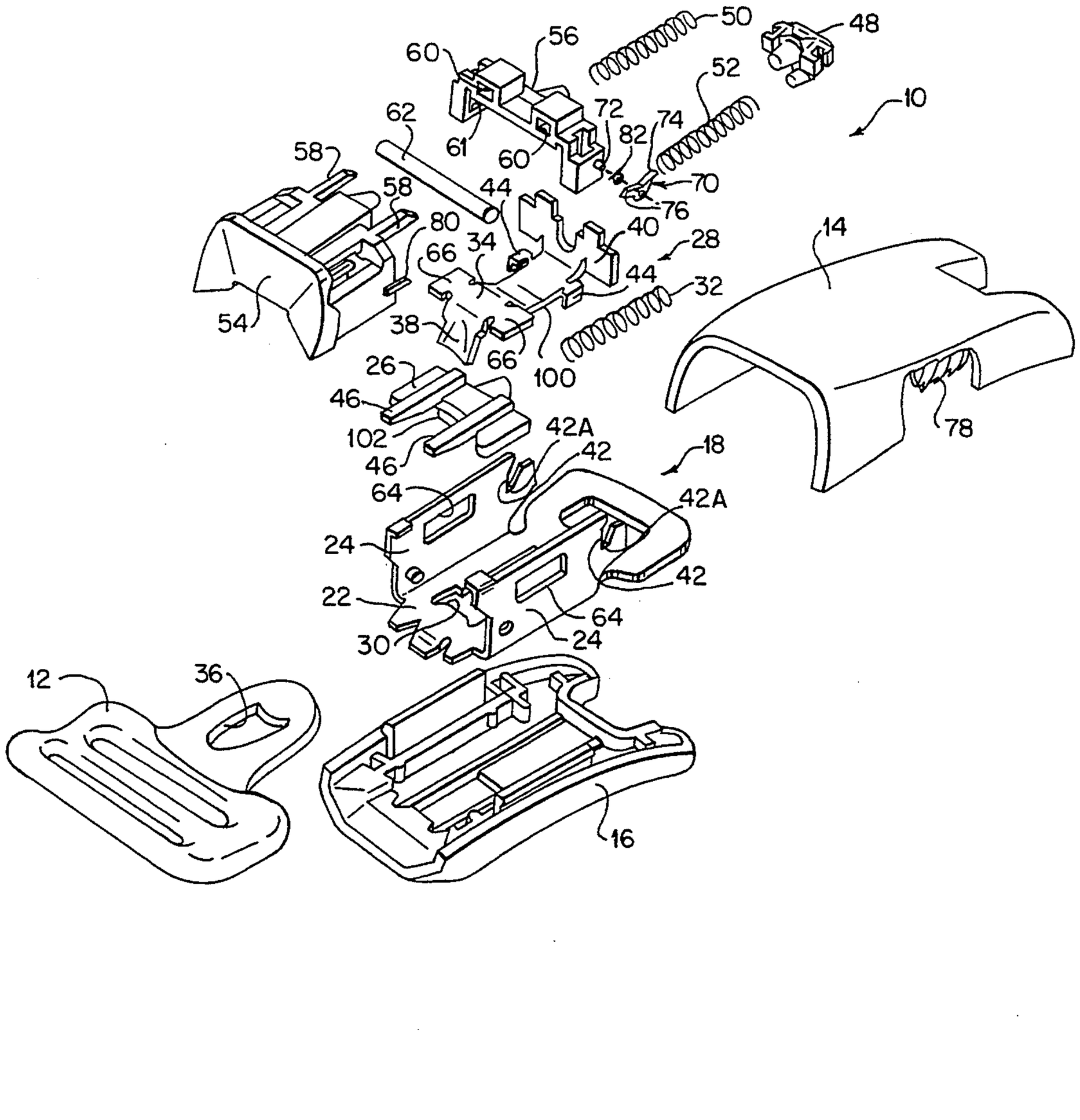
[57] **ABSTRACT**

A buckle apparatus includes a buckle body, a tongue plate, a lock plate supported by the buckle body, and being swingable between a first position for engaging the tongue plate and a second position for releasing the engagement, a lock pin moving in the tongue plate removal direction so as to prevent the lock plate from swinging toward the second position and moving in the tongue plate insertion direction so as to allow the lock plate to swing toward the second position, a release button pressing the holder so as to move the lock pin, teeth provided on the cover of the buckle body, and an engaging member being separated from the teeth in a state where the holder is in contact with the release button and engaging tile teeth so as to prevent the holder from moving in a state where the holder is separated from the release button.

19 Claims, 6 Drawing Sheets



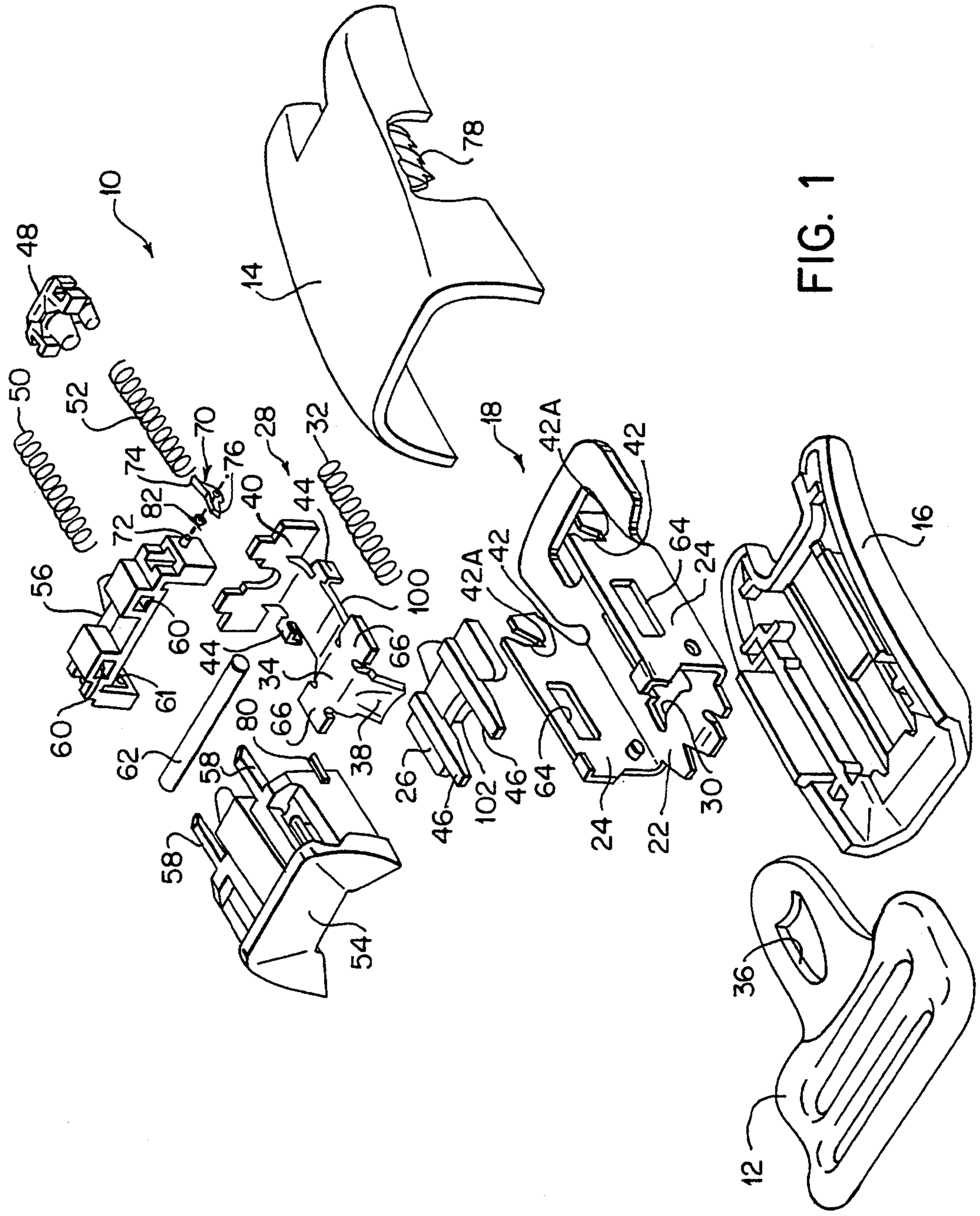

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FIG. 1

FIG. 2

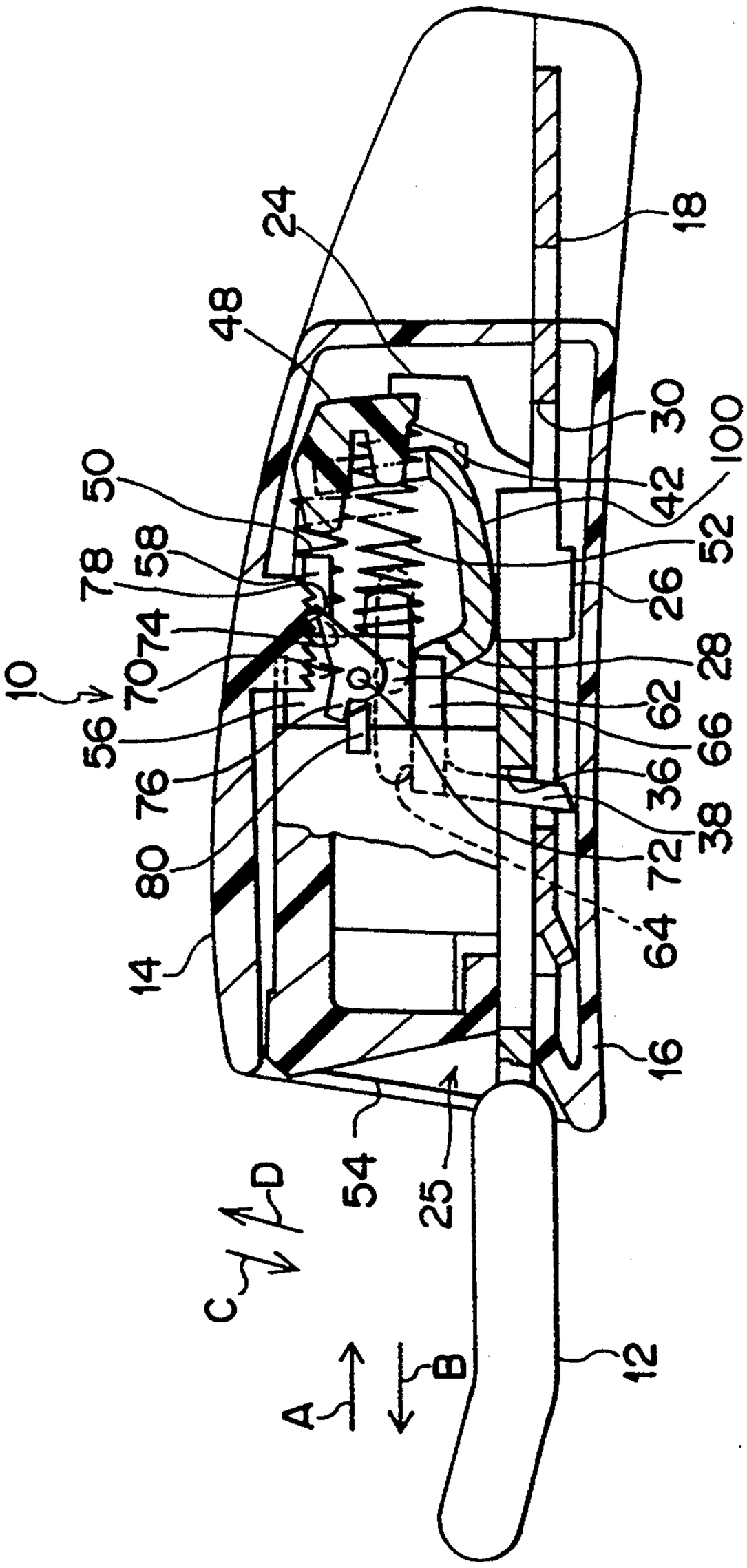
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FIG. 3

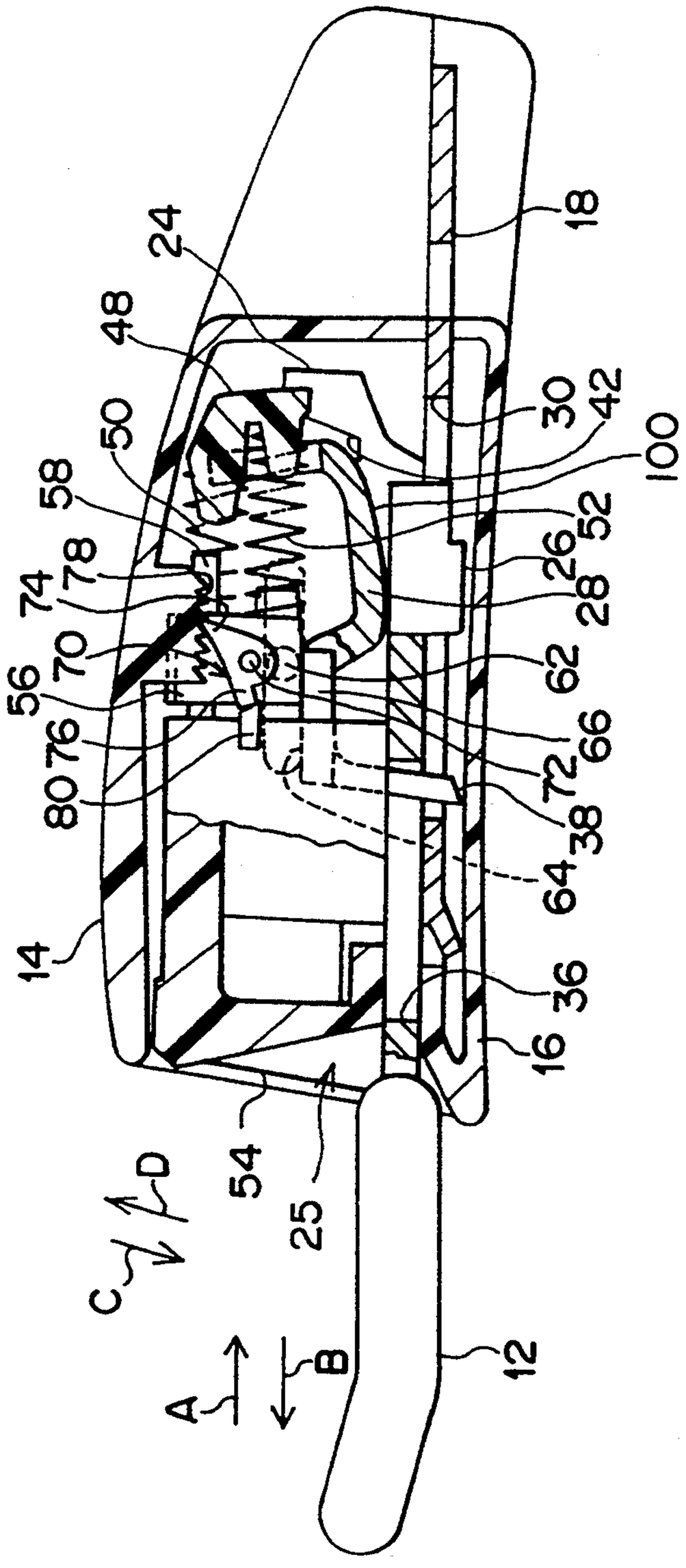
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FIG. 4

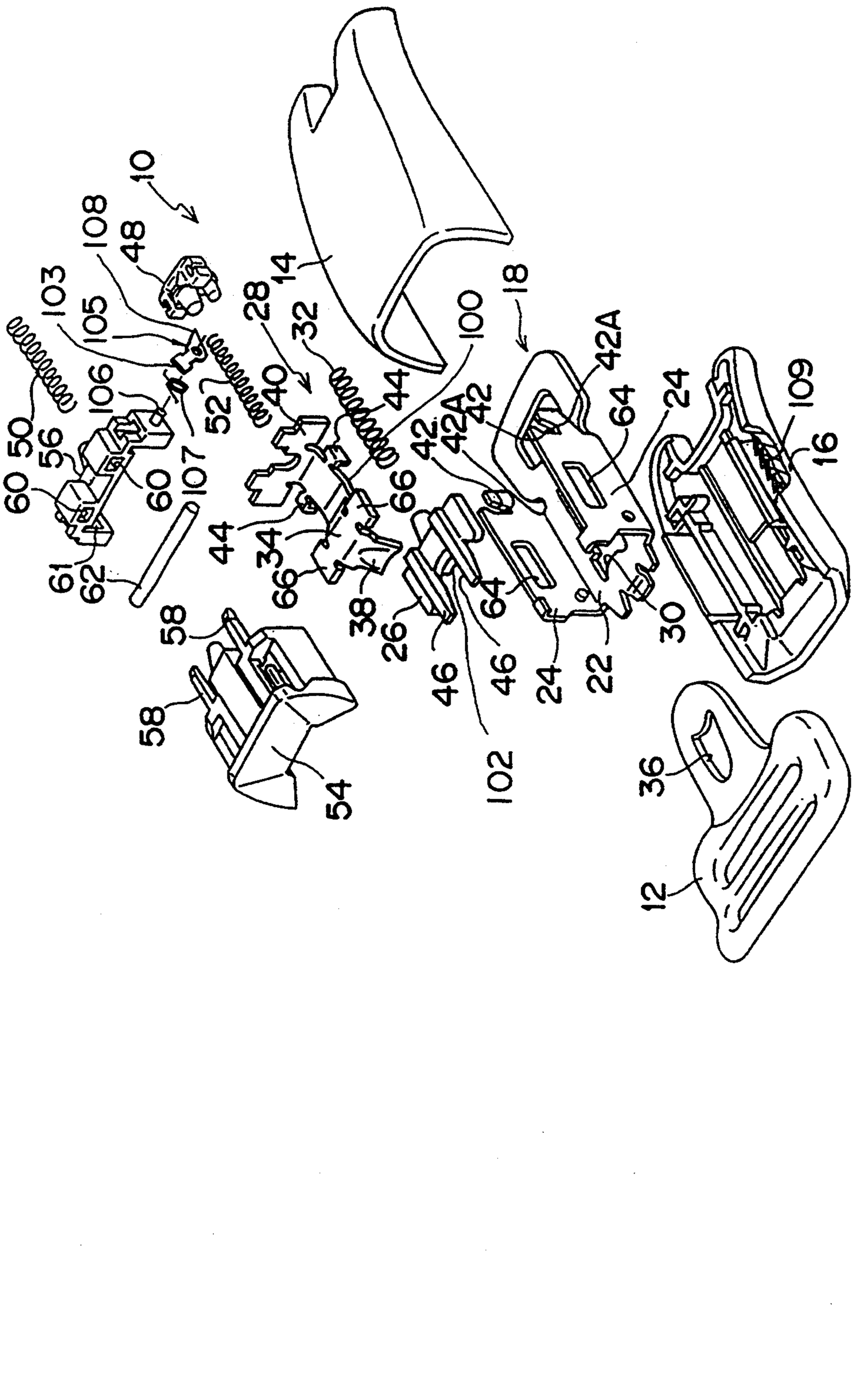
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FIG. 5

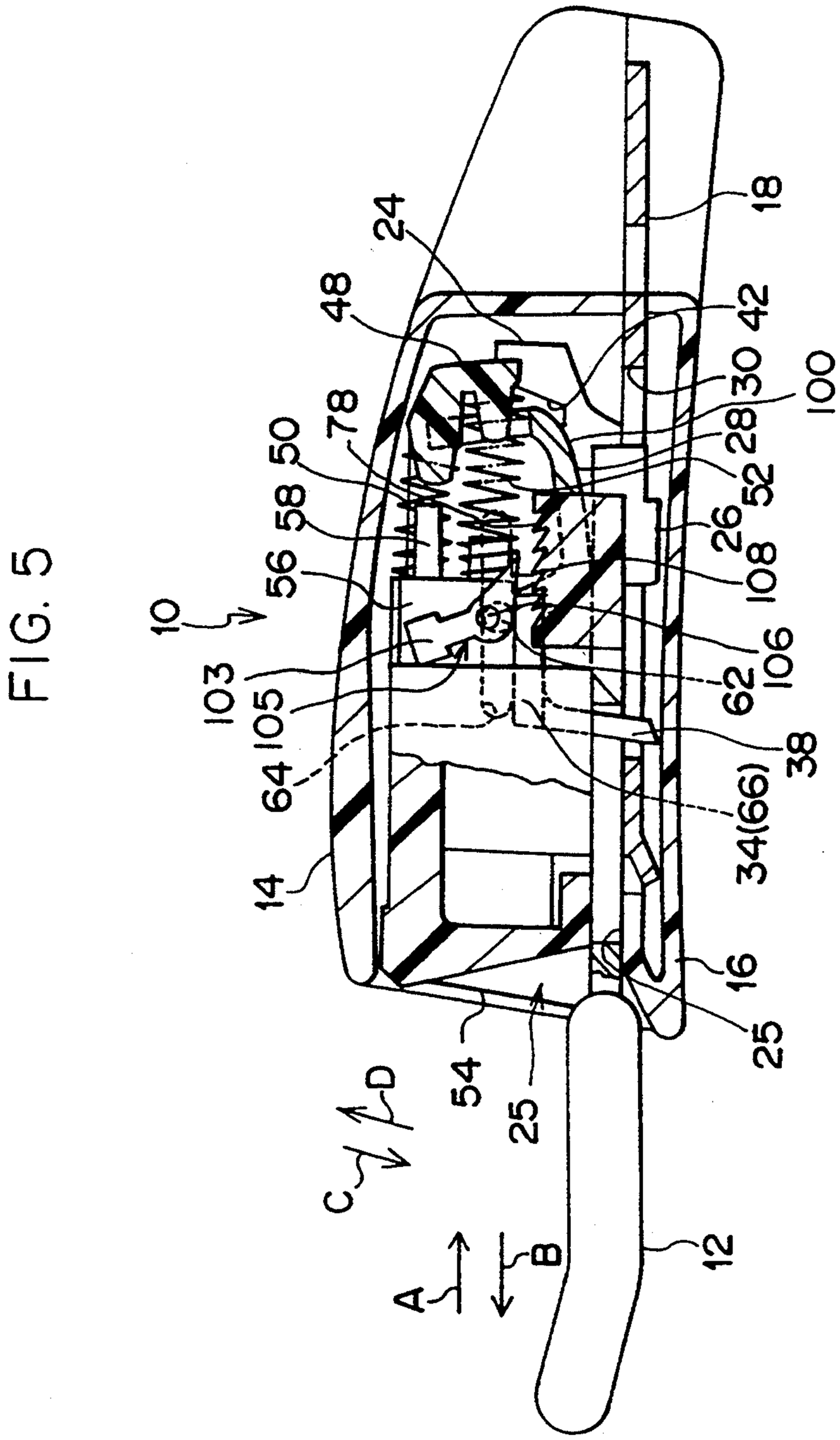
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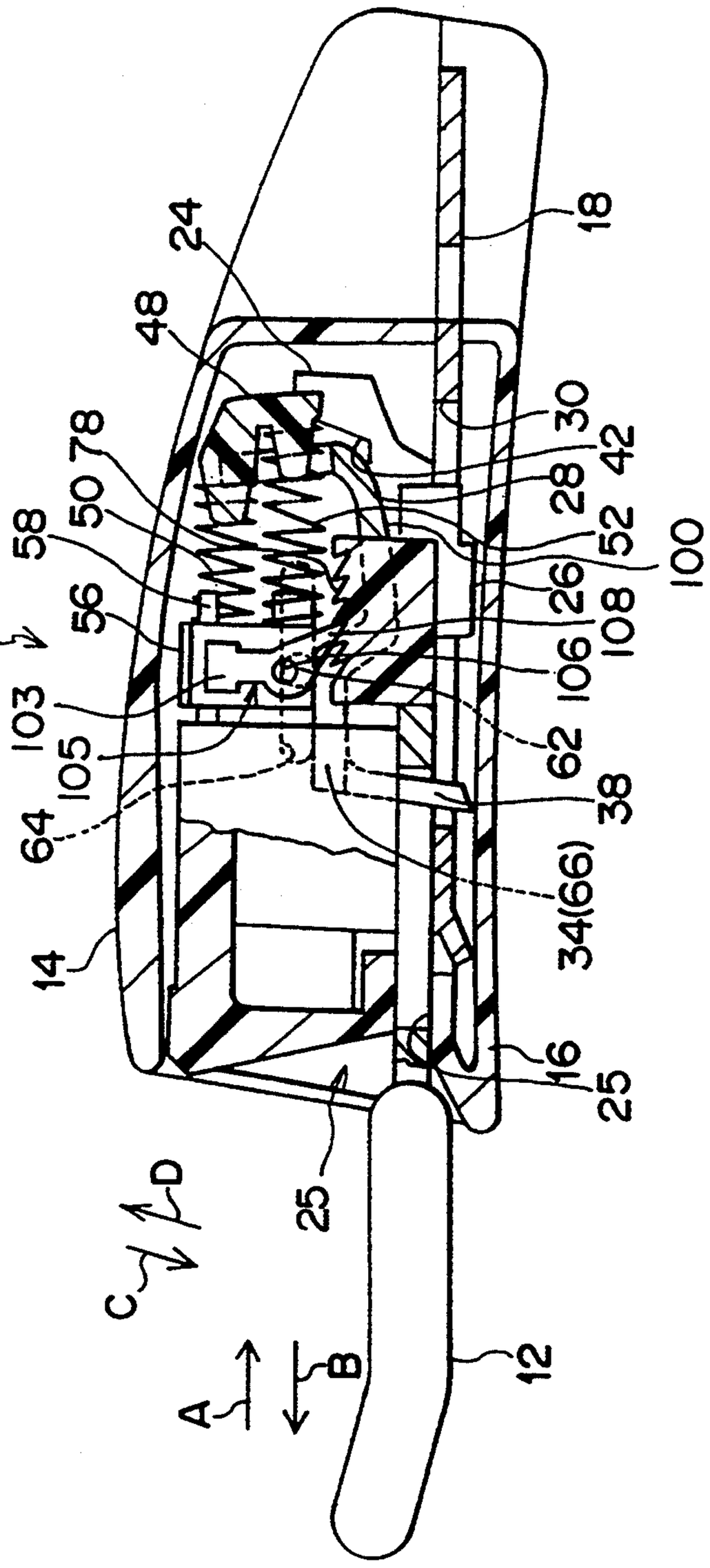
FIG. 6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BUCKLE APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a buckle apparatus for use in a seat belt system, into which a tongue plate is inserted for engagement therewith.

2. Description of the Related Art

In buckle apparatus for use in seat belt systems, there is a buckle apparatus having a so-called locking bar structure in which a lock plate for engaging a tongue plate is moved in a direction intersecting a tongue plate insertion direction and a tongue plate removal direction so as to engage the tongue plate.

In the buckle apparatus having the locking bar structure, there is provided a lock pin for holding the lock plate in a tongue plate engaging state where the lock plate engages the tongue plate. The lock pin is provided to be movable between a locked position where the lock pin holds the lock plate in the tongue plate engaging state, and a release position where the lock plate can be released from the tongue engaging state. When the lock pin is positioned at the locked position, the lock plate is held in the tongue plate engaging state, resulting in a locked condition. On the other hand, when the lock pin is positioned at the release position, the lock plate can serve to release the tongue plate engaging state.

The lock pin is urged by a spring in a direction of the locked position. That is, when the lock pin is positioned at the locked position for holding the lock plate in the tongue plate engaging state, the lock pin is urged by the spring so as to be held in the locked position. Accordingly, it is possible to hold the lock pin in the locked position without inadvertently releasing the tongue plate engaging state of the lock plate.

In order to release the engagement of the tongue plate by the lock plate, a release button is pressed against the urging forces of a return spring for urging the release button and a spring for urging the lock pin so as to forcedly move the lock pin from the locked position to the release position. Thus, the lock plate releases the tongue plate engaging state so as to remove the tongue plate from the buckle apparatus.

In the buckle apparatus having the locking bar structure as set forth above, there is an advantage in that enhanced secureness can be obtained between the tongue plate and the buckle apparatus, resulting in reliable engagement.

The lock pin is moved in the same direction from the locked position to the release position (i.e., a spring urging direction) as the release button is pressed into. Hence, in order to block movement of the lock pin due to an inertial force, the urging force of the spring for urging the lock pin is simply increased, or additional spring is required so as to enhance the holding force of the lock pin. In these cases, however, a stronger operating force is required for pressing the release button to move the lock pin to the release position so as to release the engagement.

SUMMARY OF THE INVENTION

It is an object of the present invention to obtain a buckle apparatus which can reliably hold a lock plate in a tongue plate engaging state by a lock pin without requiring a strong operating force for releasing the engagement of the tongue plate.

According to one aspect of the present invention, there is provided a buckle apparatus including a buckle body covered with a cover, a tongue plate insertable into and removable from the buckle body, a lock plate supported by tile buckle body so as to engage the tongue plate inserted thereinto, the lock plate being swingable between a first position for engaging the tongue plate and a second position for releasing the engagement, a lock pin held by a holder and positioned in contact with the lock plate, the lock pin being movable in tongue plate insertion and removal directions, the lock pin moving in the tongue plate removal direction so as to prevent the lock plate from swinging toward the second position, and moving in the tongue plate insertion direction so as to allow the lock plate to swing toward the second position, a release button supported by the buckle body for pressing the holder to move the lock pin in the tongue plate insertion direction, teeth provided on one of the cover and the buckle body, an engaging claw member attached to the holder and being engagable with the teeth, and means for engaging the engaging member with the teeth when inertial force acts to move the lock pin in the tongue plate insertion direction.

According to another aspect of the present invention, there is provided a buckle apparatus including a buckle body covered with a cover, a tongue plate insertable into and removable from the buckle body, a lock plate supported by the buckle body so as to engage the tongue plate inserted thereinto, the lock plate being swingable between a first position for engaging the tongue plate and a second position for releasing the engagement, a lock pin positioned in contact with the lock plate, the lock pin being movable in tongue plate insertion and removal directions, the lock pin moving in the tongue plate removal direction so as to prevent the lock plate from swinging toward the second position, and moving in the tongue plate insertion direction so as to allow the lock plate to swing toward the second position, a lock pin holder for holding the lock pin, a release button supported by the buckle body for pressing the holder to move the lock pin in the tongue plate insertion direction, teeth provided on one of the cover and the buckle body, and an engaging member attached to the holder, said engaging member being separated from the teeth when the holder is substantially in contact with the release button, and engaging the teeth when the holder is separated from the release button.

According to one embodiment of the present invention, the engaging claw member is preferably a lever rotatably supported by a shaft to a side wall of the holder and provided on the side where a claw portion is opposed to a cam portion with the shaft interposed therebetween. In the embodiment of the present invention, the claw portion of the lever is urged in a direction for engaging the teeth. The lever is prevented from rotating by the cam portion contacting a projection provided on the release button so as to separate the claw portion from the teeth in a state where the holder is close to the release button. On the other hand, the cam portion is separated from the projection to engage the claw portion with the teeth so as to prevent the holder from moving in a state where the holder is separated from the release button. In particular, the cam portion of the engaging member is separated from the projection of the release button so as to engage the claw portion with the teeth when the lock pin is moved by an

inertial force to a position for swinging the lock plate to the second position.

According to still another aspect of the present invention, there is provided a buckle apparatus including a buckle body covered with a cover, a tongue plate insertable into and removable from the buckle body, a lock plate supported by the buckle body so as to engage the tongue plate inserted thereinto, the lock plate being swingable between a first position for engaging the tongue plate and a second position for releasing the engagement, a lock pin positioned in contact with the lock plate, the lock pin being movable in tongue plate insertion and removal directions, the lock pin moving in the tongue plate removal direction so as to prevent the lock plate from swinging toward the second position, and moving in the tongue plate insertion direction so as to allow the lock plate to swing toward the second position, a lock pin holder for holding the lock pin, a release button supported by the buckle body for pressing the holder to move the lock pin in the tongue plate insertion direction, teeth provided on one of the cover and the buckle body, and an inertial claw member attached to the holder, and having a mass portion, the inertial claw member moving to engage the teeth when exerting an inertial force on the inertial claw member.

According to the embodiment of the present invention, the engaging member is preferably a lever rotatably supported by a shaft at a side wall of the holder and provided on the side where a mass portion is opposed to a claw portion with the shaft interposed therebetween. The claw portion of the lever is urged in the direction for engaging the teeth. The lever is prevented from rotating by the mass portion contacting the back portion of the release button so as to separate the claw portion from the teeth in a state where the holder is substantially in contact with the release button. On the other hand, the mass portion is rotated and moved by an inertial force to engage the claw portion with the teeth so as to prevent the holder from moving when inertial force is exerted in the tongue plate insertion direction.

According to the embodiment of the present invention, the lock plate includes a U-shaped portion bent downward in a U-shaped configuration at an end of the lock plate on a tongue plate inserting side, a rising portion bent upward at the other end thereof, and a connecting portion for connecting the U-shaped portion and the rising portion. A distal end of the U-shaped portion serves as an engaging portion for engaging an engaging hole of the tongue plate. The lock pin is positioned at an intermediate portion of the U-shaped portion when the lock plate is held in the first position, and the lock pin is positioned at the connecting portion when the lock plate is held in the second position.

The buckle apparatus of the present invention is suitable for seat belt systems.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view of one embodiment of a buckle apparatus of the present invention;

FIG. **2** is a schematic sectional view showing a tongue plate engaging state of the buckle apparatus of FIG. **1**;

FIG. **3** is a schematic sectional view showing a lever engaging state of the buckle apparatus of FIG. **1**;

FIG. **4** is an exploded perspective view of another embodiment of the buckle apparatus of the present invention;

FIG. **5** is a schematic sectional view showing a tongue plate engaging state of the buckle apparatus of FIG. **4**; and

FIG. **6** is a schematic sectional view showing a lever engaging state of the buckle apparatus of FIG. **4**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **1** to **3** illustrate a buckle apparatus **10** of the present invention, and a tongue plate **12** which is engagably inserted into the buckle apparatus **10**.

In the buckle apparatus **10**, a buckle body **18** is arranged between an upper cover **14** and a lower cover **16**. In FIG. **1**, the tongue plate **12** is inserted into the buckle apparatus **10** from the left side of the drawing (hereafter referred to as tongue plate inserting side). A webbing (not shown) is coupled to an end of the buckle apparatus **10** on the right side of the drawing (hereafter referred to as webbing coupled side). The buckle body **18** is provided with a pair of leg plate portions **24** which are bent on both sides of a flat plate portion **22** in a lateral direction. The tongue plate **12** is inserted between the pair of leg plate portions **24** through an opening **25** provided between the upper cover **14** and the lower cover **16**.

An ejector **26** and a lock plate **28** are arranged between the pair of leg plate portions **24** of the buckle body **18**.

The ejector **26** is inserted into a guide hole **30** which is provided in the flat plate portion **22** of the buckle body **18** so as to be movable in the tongue plate insertion direction (i.e., in a direction shown by the arrow A in FIGS. **2** and **3**) and in the tongue plate removal direction (i.e., in a direction shown by the arrow B in FIGS. **2** and **3**). An end of the ejector **26** on the webbing coupled side is fitted with one end of a compression coil spring **32**. The other end of the compression coil spring **32** is secured to the buckle body **18**. Consequently, the ejector **26** is urged by the compression coil spring **32** in the tongue plate removal direction (i.e., in the direction shown by the arrow B in FIGS. **2** and **3**).

The ejector **26** is provided with a portion **102** which contacts a distal end of the tongue plate **12** when inserting the tongue plate **12**. When the tongue plate **12** is inserted into the buckle body **18** as shown in FIG. **2**, the tongue plate **12** presses the contact portion **102** of the ejector **26** so as to move the ejector **26**.

The lock plate **28** extends longitudinally in the tongue plate insertion and removal directions and has a distal end portion, i.e., the end on the tongue plate inserting side orthogonally bent downward to form a substantially U-shaped portion **34**. The distal end of the U-shaped portion **34** serves as an engaging portion **38** for engaging an engaging hole **35** in the tongue plate **12**. The engaging portion **38** is fitted into the engaging hole **36** of the tongue plate **12** for engagement with the tongue plate **12**.

A rising portion **40** extends upward from an end of the lock plate **28** on the side opposite the U-shaped portion **34** (i.e., on the webbing coupled side). The rising portion **40** has a width wider than that of the lock plate **28** in the lateral direction of the lock plate **28**. Both lateral ends of the rising portion **40** are supported by the pair of leg plate portions **24** of the buckle body **18** so that the lock plate **28** is disposed between the leg plate portions **24**. Substantially triangular notches **42** are provided in ends of the leg plate portions **24** on the webbing coupled side. Both lateral ends of the rising portion **40**

of the lock plate **28** are inserted into the notches **42**. Therefore, the lock plate **28** is swingable with top portions **42A** of the notches **42** as a center of swinging in two directions shown by the arrows C and D in FIGS. **2** and **3**. In the direction shown by the arrow C in FIGS. **2** and **3** (hereafter briefly referred to as engaging direction), the engaging portion **38** engages the engaging hole **36** of the tongue plate **12**. Further, in the direction shown by the arrow D in FIGS. **2** and **3** (hereafter briefly referred to as releasing direction), the engaging portion **38** is released from the engaging hole **36** of the tongue plate **12**.

When the tongue plate **12** is being removed, the distal end of the engaging portion **38** is in contact with an upper surface of the ejector **26** so that the lock plate **28** is swung in the releasing direction (i.e., in the direction shown by the arrow D in FIG. **2**).

Further, bent portions **44** extending downward are provided at longitudinal intermediate portions of the lock plate **28** between the U-shaped portion **34** and the rising portion **40**. The bent portions **44** are opposite the ends of blocks **46** on the webbing coupled side on the upper surface of the ejector **26**. The block **46** extends in the tongue plate insertion and removal directions. When the tongue plate **12** is inserted, the ejector **26** is moved in the tongue plate insertion direction so as to push the bent portions **44** in the tongue plate insertion direction so as to swing the lock plate **28** in the engaging direction. The lock plate **28** engages the tongue plate **12** by this swinging and by the engaging hole **36** of the tongue plate **12** reaching the distal end of the engaging portion **38**.

A spring holder **48** is provided for the lock plate **28** and is secured by the rising portion **40**. One of the ends of compression coil springs **50** and **52** are respectively fitted to the spring holder **48**. The other ends of the two compression coil springs **50**, **52** are respectively fitted to the release button **54** and a lock pin holder **56**. The release button **54** and the lock pin holder **56** are respectively urged by the compression coil springs **50** and **52** in the tongue plate removal direction.

The release button **54** is provided on the tongue plate inserting side with respect to the lock pin holder **56**, and is movable in the tongue plate insertion direction against the urging force of the compression coil spring **50**. At an end of the release button **54** on the webbing coupled side, blocks **58** extend toward the webbing coupled side. The blocks **58** movably pass in an axial direction through rectangular holes **60** which are provided in upper ends of the lock pin holder **56**. When the release button **54** is pressed against the urging force of the compression coil spring **50** in the tongue plate insertion direction, the blocks **58** contact upper ends of the rising portion **40** of the lock plate **28**. Subsequently, the blocks **58** press the rising portion **40** of the lock plate **28** so as to swing the lock plate **28** in the releasing direction. The lock plate **28** is swung so that the engaging portion **38** of the tongue plate **12** is removed from the engaging hole **36** of the tongue plate **12**.

The lock pin holder **56** is urged by the compression coil spring **52** on the tongue plate inserting side, that is, in a direction of the release button **54**. The lock pin holder **55** is provided with holding holes **61** for holding both ends of a lock pin **62**. Horizontally elongated bearing holes **64** are provided in the leg plate portions **24** of the buckle body **18**. The lock pin **52** passes through the bearing holes **64**, and is supported by the holding holes **61** of the lock pin holder **56** outside the leg plate portions **24**. Therefore, the lock pin **52** is supported by the bearing holes **64** so as to be movable in the tongue plate insertion and removal directions.

An intermediate portion of the U-shaped portion **34** serves as a positioning plate portion **66** extending in the lateral direction of the lock plate **28**. The lock pin **62** is positioned on an upper surface of the positioning plate portion **66** in a state where the tongue plate is engaged. The lock pin **62** is positioned on a connecting portion **100** for connecting the U-shaped portion **34** and the rising portion **40** in a state where the tongue plate is removed. There is provided a locked condition where the lock plate **28** is prevented from swinging in the releasing direction in case the lock pin **62** is positioned on the upper surface of the positioning plate portion **66**. On the other hand, the release button **54** is moved in the tongue plate insertion direction to move the lock pin **62** with the lock pin holder **56** in the tongue plate insertion direction. Accordingly, the lock pin **62** is positioned on the connecting portion. In this condition, there is provided a release condition where the lock pin **62** allows the lock plate **28** to swing in the releasing direction.

A lever **70** serving as an engaging claw member is rotatably supported by a supporting pin **72** on a side wall portion of the lock pin holder **56**. Further, a helical coil spring **82** is mounted around the supporting pin **72**.

A claw portion **74** and a cam portion **76** are respectively provided at ends of the lever **70**. The claw portion **74** can engage teeth **78** which serve as engaging teeth provided on the upper cover **14**. In a condition where the claw portion **74** engages the teeth **78**, the lock pin holder **56** is prevented from moving in the tongue plate insertion direction. That is, the lock pin **62** is prevented from moving toward the release condition. The lever **70** is continuously urged by the helical coil spring **82** in a direction in which the claw portion **74** engages the teeth **78**.

The cam portion **76** of the lever **70** contacts a projection **80** projecting from the release button **54** so as to block a rotation of the teeth **78**. That is, the projection **80** contacts the cam portion **76** to hold the cam portion **76** so that the claw portion **74** of the lever **70** is separated from the teeth **78** of the upper cover **14** in a state where the release button **54** is close to the lock pin holder **56** (see FIG. **2**). When the lock pin holder **56** is separated from the release button **54**, the projection **80** holding the cam portion **76** is released so as to freely rotate the lever **70**. Thereby, the lever **70** is rotated by the urging force of the helical coil spring **82** to engage the claw portion **74** with the teeth **78**.

A description will now be given of the operation of the embodiment.

When the tongue plate **12** is inserted into the buckle apparatus **10**, the distal end of the tongue plate **12** contacts and pushes the ejector **26** against the urging force of the compression coil spring **32** in the tongue plate insertion direction (in the arrow A of FIG. **2**). The tongue plate **12** moves the ejector **26** in the tongue plate insertion direction. Along the way, the ejector **26** contacts the bent portions **44** of the lock plate **28** so as to press the bent portions **44** of the lock plate **28** in the tongue plate insertion direction. The ejector **26** moves in the tongue plate insertion direction so as to swing the lock plate **28** in the engaging direction (i.e., in the direction shown by the arrow C in FIG. **2**). Accordingly, the engaging portion **38** of the lock plate **28** is fit into the engaging hole **36** when the tongue plate **12** is inserted into the buckle apparatus **10**, and the engaging hole **36**

of the tongue plate **12** is positioned directly below the engaging portion **38** of the lock plate **28**.

At this time, tile lock pin **62** is movable in the tongue plate removal direction through the swinging of the lock plate **28**. Consequently, the lock pin **62** is urged by the compression coil spring **52** through the lock pin holder **56** so as to move in the tongue plate removal direction. In a condition where the engaging portion **38** of the lock plate **28** is fit into the engaging hole **36** of the tongue plate **12**, the lock pin **62** is positioned on the upper surface of the positioning plate portion **66**, resulting in the locked condition (which is shown in FIG. **2**).

Therefore, in the tongue plate engaging state shown in FIG. **2**, the lock plate **28** is prevented by the lock pin **62** from swinging in the releasing direction (i.e., in the direction shown by the arrow D in FIG. **2**). Hence, the engaging portion **38** of the lock plate **28** is prevented from being disengaged from the engaging hole **36** of the tongue plate **12**. As a result, the tongue plate **12** is not inadvertently removed from the buckle apparatus **10**.

The lock pin holder **55** is close to the release button **54**, and the cam portion **76** of the lever **70** contacts the projection **80** to be held thereby in a state where the lock plate **28** prevents the tongue plate **12** from being removed, that is, in the locked condition in which the lock pin **62** is moved in the tongue plate removal direction. Accordingly, the claw portion **74** of the lever **70** is spaced apart from the teeth **78** of the upper cover **14**. Hence, the lock pin holder **56** and the lock pin **62** are movable by pressing the release button **54**.

It is assumed that the buckle apparatus **10** is in a state where the lock plate **28** prevents the tongue plate **12** from being removed, that is, in the locked condition where the lock pin **62** is moved in the tongue plate removal direction. In this condition, if an inertial force is exerted on the lock pin **62** in a direction for moving from the lock condition to the release condition (i.e., in the tongue plate insertion direction), the lock pin holder **56** is separated along with the lock pin **62** from the release button **54** so as to move in the tongue plate insertion direction. Thus, the cam portion **76** of the lever **70** mounted on the lock pin holder **56** is disengaged from the projection **80**, and the projection **80** holding the cam portion **76** is released so the lever **70** can be rotated. Further, the lever **70** is rotated by the urging force of the helical coil spring **82** to engage the claw portion **74** with the teeth **78**. As a result, the lock pin holder **56** is prevented from moving, and the lock pin **62** is not moved from the locked condition to the release condition (i.e., the lock pin **62** being in a state shown in FIG. **3**).

As set forth above, even if exerting the inertial force in the direction for moving the lock pin **62** from a locked position to a release position, the lock pin **62** is prevented from moving so as to reliably maintain the locked condition of the lock pin **62**.

Thereafter, if no inertial force is exerted, the lock pin holder **56** is urged by the compression coil spring **52** in the tongue plate removal direction. Accordingly, the lock pin holder **56** is moved in the direction of the release button **54**, and the cam portion **76** is rotated counterclockwise while climbing up a distal end of the projection **80**. Consequently, the claw portion **74** is removed from the teeth **78**. Thus, the lock pin holder **56** can return to an original condition where the lock pin holder **56** is in contact with the release button **54**.

On the other hand, when the tongue plate **12** is released from the buckle apparatus **10**, the release button **54** is close to the lock pin holder **56**, and the claw portion **74** of the lever **70** is separated from the teeth **78** of the upper cover **14**. That is, the lock pin holder **56** is in a movable state. Hence, it is possible to press the release button **54** in a state shown in FIG. **2** against the urging force of the compression coil spring **50** in the tongue plate insertion direction so as to move the lock pin holder **56**. In other words, when the release button **54** moves, the release button **54** presses the lock pin holder **56**, and the lock pin holder **56** is moved against tile urging force of the compression coil springs **50** and **52** in the tongue plate insertion direction. The lock pin **62** is moved on the webbing coupled side with respect to the positioning plate portion **66** of the lock plate **28** due to the movement of the lock pin holder **56**. Further, the blocks **58** of the release button **54** contact the upper ends of the rising portion **40** of the lock plate **28**. Subsequently, the release button **54** presses the rising portion **40** of the lock plate **28** in the tongue plate insertion direction so as to swing the lock plate **28** in the releasing direction (i.e., in the direction shown by the arrow D in FIG. **2**). The engaging portion **38** is disengaged from the engaging hole **36** of the tongue plate **12** due to the swinging of the lock plate **28**. Concurrently, the ejector **26** is urged by the compression coil spring **32** to move in the tongue plate removal direction, and the ejector **26** presses the tongue plate **12** so as to be ejected out of the buckle apparatus **10**. The release button **54** then returns to the condition shown in FIG. **2**. In such a way, it is possible to perform the operation for releasing the engaging of the tongue plate as in the conventional buckle apparatus.

As set forth above, in the buckle apparatus **10**, it is not necessary to simply increase the urging force of the spring of employ an additional spring in order to hold the lock pin **62** in the locked condition. Therefore, it is possible to reliably hold the lock plate **28** in the tongue plate engaging state by the lock pin **62** without the need of a stronger release operating force for releasing the tongue plate **12**.

In the embodiment, the teeth **78** serving as engaging teeth are provided on the upper cover **14**. However, it must be noted that the present invention should not be limited to the embodiment. The teeth may be provided on the buckle body **18**. In this case, the claw portion **74** of the lever **70** engages the teeth so as to prevent the lock pin holder **56** from moving if inertial force is exerted in the direction for moving the lock pin **62** from the locked condition to the release condition. As a result, it is also possible to reliably hold the lock pin **62** in the locked condition without moving the lock pin **62** from the locked condition to the release condition.

Referring to FIGS. **4** to **6**, a description will now be given of another embodiment of the buckle apparatus of the present invention. The structures and operations of the lock plate **28**, the lock pin **62**, the ejector **26**, the tongue plate **12**, the buckle body **18**, and the lock pin holder **56** are identical with those in the previous embodiment, and a description of the structures and operations is omitted.

In the embodiment, a lever **105** serving as an inertial claw (engaging) member is rotatably supported by a supporting pin **106** at a side wall portion of the lock pin holder **56**. Further, a helical coil spring **107** is mounted around the supporting pin **106**.

A claw portion **108** is provided at one end of the lever **105**, and a mass portion **103** is provided at the other end thereof. The claw portion **108** has a tapered end extend-

ing in a direction which is slightly rotated counterclockwise with respect to a prolongation extending from the mass portion **103** across the supporting pin **106**. The mass portion **103** of the lever **105** is defined as, for example, an inertial mass portion in which a deadweight such as lead is embedded. Therefore, the mass portion **103** receives a large inertial force. On the other hand, corrugated teeth **109** are provided at a side wall portion of the lower cover **16** along the tongue plate insertion and removal directions. The claw portion **108** of the lever **105** can engage the teeth **109**. In a condition where the claw portion **108** engages the teeth **109**, the lock pin holder **56** is prevented from moving in the tongue plate insertion direction, that is, the lock pin **62** is prevented from moving to the release condition. The lever **105** is continuously urged by the helical coil spring **107** in a direction in which the claw portion **108** is separated from the teeth **109**, that is, in a counterclockwise direction.

In the locked condition of the lock pin **62** where the lock pin holder **56** is close to the release button **54**, the helical coil spring **107** causes the mass portion **103** of the lever **105** to contact the release button **54** so as to block the rotation of the mass portion **103** (in this state, the claw portion **108** of the lever **105** is held apart from the teeth **109**). When the mass portion **103** receives the inertial force in the tongue plate insertion direction (that is, in the release direction of the lock pin **62**), the lever **105** is rotated against the urging force of the helical coil spring **107** so as to engage the claw portion **108** with the teeth **78**.

A description will now be given of the operation of the embodiment.

When the tongue plate **12** is inserted into the buckle apparatus **10**, the distal end of the tongue plate **12** contacts the ejector **26** to press the ejector **26** against the urging force of the compression coil spring **32** in the tongue plate insertion direction (in the arrow A of FIG. **5**). The tongue plate **12** moves the ejector **26** in the tongue plate insertion direction. Along the way, the ejector **26** contacts and presses the bent portions **44** of the lock plate **28** in the tongue plate insertion direction. The ejector **26** moves in the tongue plate insertion direction so as to swing the lock plate **28** in the engaging direction (i.e., in the direction shown by the arrow C in FIG. **5**). Accordingly, when the tongue plate **12** is inserted into the buckle apparatus **10** and the engaging hole **36** of the tongue plate **12** is positioned directly below the engaging portion **38** of the lock plate **28**, the engaging portion **38** of the lock plate **28** is fit into the engaging hole **36**.

At this time, the lock pin **62** is movable in the tongue plate removal direction through the swinging of the lock plate **28**. Consequently, the lock pin **62** is urged by the compression coil spring **52** through the lock pin holder **56** so as to move in the tongue plate removal direction. In a condition where the engaging portion **38** of the lock plate **28** is fit into the engaging hole **36** of the tongue plate **12**, the lock pin **62** is positioned on the upper surface of the positioning plate portion **66**, resulting in the locked state (which is shown in FIG. **5**).

Therefore, in the tongue plate engaging state shown in FIG. **5**, the lock plate **28** is prevented by the lock pin **62** from swinging in the releasing direction (i.e., in the direction shown by the arrow D in FIG. **5**). Hence, the engaging portion **38** of the lock plate **28** is prevented from being disengaged from the engaging hole **36** of the tongue plate **12**. As a result, the tongue plate **12** is not inadvertently removed from the buckle apparatus **10**.

The mass portion **103** of the lever **105** attached to the lock pin holder **56** is in contact with the release button **54** in a state where the tongue plate **28** prevents the tongue plate **12** from being removed, that is, in the locked condition in which the lock pin **52** is moved in the tongue plate removal direction. Accordingly, the claw portion **108** is separated from the teeth **109** of the lower cover **16**. Hence, the lock pin holder **56** and the lock pin **62** are movable by pressing the release button **54**.

It is assumed that the buckle apparatus **10** is in a state where the lock plate **28** prevents the tongue plate **12** from being removed, that is, in the locked condition where the lock pin **62** is moved in the tongue plate removal direction. In this condition, if inertial force is exerted on the lock pin **62** in a direction for moving from the lock condition to the release condition (i.e., in the tongue plate insertion direction), the lock pin holder **56** is separated, together with the lock pin **62**, from the release button **54** so as to move in the tongue plate insertion direction. However, the inertial force exerted on the lock pin **62** is also exerted on the mass portion **103** of the lever **105**. Therefore, the lever **105** is rotated against the urging force of the helical coil spring **107** about the supporting pin **106** so as to engage the claw portion **108** with the teeth **109**. As a result, the lock pin holder **56** is prevented from moving, and the lock pin **62** is not moved from the locked condition to the release condition (see FIG. **6**).

As set forth above, even if exerting inertial force in the direction for moving the lock pin **62** from a locked position to a release position, the lock pin **62** is prevented from moving so as to reliably maintain the locked condition of the lock pin **62**.

Thereafter, if no inertial force is exerted, the lock pin holder **56** is urged by the compression coil spring **52** in the tongue plate removing direction. Accordingly, the lock pin holder **56** is moved in the direction of the release button **54**, and the mass portion **103** is rotated counterclockwise by the urging force of helical coil spring **107**. As a result, the claw portion **108** of the lever is separated from the engaging teeth **109**. Thus, the lock pin holder **56** can return to an original condition where the holder **56** is in contact with the release button **54**.

On the other hand, when the tongue plate **12** is released from the buckle apparatus **10**, the claw portion **108** of the lever **105** attached to the lock pin holder **56** is separated from the teeth **109** of the lower cover **16**. That is, the lock pin holder **56** is in a movable state. Hence, it is possible to press the release button **54** in a state shown in FIG. **5** against the urging force of the compression coil spring **50** in the tongue plate insertion direction so as to move the lock pin holder **56**. In other words, when the release button **54** moves, the release button **54** presses the lock pin holder **56**, and the lock pin holder **56** is moved against the urging force of tile compression coil springs **50** and **52** in the tongue plate insertion direction. The lock pin **62** is moved on the webbing coupled side with respect to the positioning plate portion **66** of tile lock plate **28** due to the movement of the lock pin holder **56**. Further, the blocks **58** of the release button **54** contact the upper ends of the rising portion **40** of the lock plate **28**. Subsequently, the release button **54** presses the rising portion **40** of the lock plate **28** in the tongue plate insertion direction so as to swing the lock plate **28** in the releasing direction (i.e.,

in the direction shown by the arrow D in FIG. 5). In this process, the lock pin **62** is moved from an upper surface of the positioning plate portion **66** onto the connecting portion **100**. The engaging portion **38** is disengaged from the engaging hole **36** of the tongue plate **12** due to the swinging of the lock plate **28**. Concurrently, the ejector **26** is urged by the compression coil spring **32** to move in the tongue plate removal direction, and the ejector **26** presses the tongue plate **12** so as to be ejected out of the buckle apparatus **10**. The release button **54** then returns to the condition shown in FIG. **5** again. In this way, it is possible to perform the operation for releasing the tongue plate as in the conventional buckle apparatus.

As set forth above, in the buckle apparatus **10**, it is not necessary to simply increase the urging force of the spring of employ an additional spring in order to hold the lock pin **62** in the locked condition. Therefore, it is possible to reliably hold the lock plate **28** in the tongue plate engaging state by the lock pin **62** without a stronger release operating force for releasing the tongue plate **12**.

In the embodiment, the teeth **109** serving as engaging teeth are provided at the lower cover **16**. However, it must be noted that the present invention should not be limited to the embodiment, and the teeth may be provided at an upper cover **14** or the buckle body **18**. In this case, it is also possible to obtain the same effects as set forth above.

Further, the lever **105** is urged by using the helical coil spring **82** in the embodiment. However, the lever **105** may be urged by coupling the mass portion **103** or the claw portion **108** of the lever **105** with a coil spring **107** which is supported by the lock pin holder **56**.

As described hereinbefore, in the buckle device of the present invention, there are excel lent effects in that stronger release operating force is not required for releasing the tongue plate, and the lock plate can be reliably maintained by the lock pin in the tongue plate engaging state.

What is claimed is:

1. A buckle apparatus comprising:

a buckle body covered with a cover;

a tongue plate insertable into and removable from said buckle body;

a lock plate supported by said buckle body so as to engage said tongue plate inserted thereinto, said lock plate being swingable between a first position for engaging said tongue plate and a second position for releasing said engagement;

a lock pin held by a holder and positioned in contact with said lock plate, said lock pin being movable in tongue plate insertion and removal directions, said lock pin moving in said tongue plate removal direction so as to prevent said lock plate from swinging toward said second position, and moving in said tongue plate insertion direction so as to allow said lock plate to swing toward said second position;

a release button supported by said buckle body for pressing said holder to move said lock pin in said tongue plate insertion direction;

teeth provided on one of said cover and said buckle body;

an engaging member attached to said holder and being engagable with said teeth; and

means for engaging said engaging member with said teeth when inertial force acts to move said lock pin in said tongue plate insertion direction.

2. A buckle apparatus according to claim **1**, wherein said engaging means includes a mass portion which is secured to said engaging member and which rotates said engaging member by an inertial force so as to engage the tip of said engaging member with said teeth, and urging means for urging said engaging member in a direction for removing said engaging member from said teeth.

3. A buckle apparatus according to claim **1**, wherein said engaging means includes a projection provided at a back portion of said release button, a cam portion secured to said engaging member and being able to contact said projection, and urging means for urging the tip of said engaging member in a direction in which said tip of the engaging member engages said teeth.

4. A buckle apparatus comprising:

a buckle body covered with a cover;

a tongue plate insertable into and removable from said buckle body;

a lock plate supported by said buckle body so as to engage said tongue plate inserted thereinto, said lock plate being swingable between a first position for engaging said tongue plate and a second position for releasing said engagement;

a lock pin positioned in contact with said lock plate, said lock pin being movable in tongue plate insertion and removal directions, said lock pin moving in said tongue plate removal direction so as to prevent said lock plate from swinging toward said second position, and moving in said tongue plate insertion direction so as to allow said lock plate to swing toward said second position;

a lock pin holder for holding said lock pin;

a release button supported by said buckle body for pressing said holder to move said lock pin in said tongue plate insertion direction;

teeth provided on one of said cover and said buckle body; and

an engaging member attached to said holder, said engaging member being separated from said teeth when said holder is substantially in contact with said release button, and engaging Said teeth when said holder is separated from said release button.

5. A buckle apparatus according to claim **4**, wherein said engaging member is a lever rotatably supported by a shaft at a side wall of said holder and having a claw portion and a cam portion disposed at opposing sides of the shaft.

6. A buckle apparatus according to claim **5**, wherein said claw portion of said lever is urged in a direction in which said claw portion engages said engaging teeth, said lever being prevented from rotating by said cam portion contacting a projection provided on said release button so as to separate said claw portion from said teeth in a state where said holder is substantially in contact with said release button, and said cam portion being separated from said projection to engage said claw portion with said teeth so as to prevent said holder from moving in a state where said holder is separated from said release button.

7. A buckle apparatus according to claim **5**, wherein a helical spring is provided around said shaft of the lever so as to urge said claw portion of said lever in a direction in which said claw portion engages said teeth.

8. A buckle apparatus according to claim **4**, wherein said lock plate includes a U-shaped portion bent downward in a U-shaped configuration at an end of said lock plate on a tongue plate inserting side, a rising portion

bent upward at another end thereof, and a connecting portion for connecting said U-shaped portion and said rising portion, a distal end of said U-shaped portion serving as an engaging portion for engaging an engaging hole of said tongue plate, said lock pin being positioned at an intermediate portion of said U-shaped portion when said lock plate is held in said first position, and said lock pin being positioned at said connecting portion when said lock plate is held in said second position.

9. A buckle apparatus according to claim **4**, wherein said lock pin holder is urged by a spring to be in contact with said release button in a normal condition.

10. A buckle apparatus comprising:

a buckle body covered with a cover;

a tongue plate insertable into and removable from said buckle body;

a lock plate supported by said buckle body so as to engage said tongue plate inserted thereinto, said lock plate being swingable between a first position for engaging said tongue plate and a second position for releasing said engagement;

a lock pin positioned in contact with said lock plate, said lock pin being movable in tongue plate insertion and removal directions, said lack pin moving in said tongue plate removal direction so as to prevent said lack plate from swinging toward said second position, and moving in said tongue plate insertion direction so as to allow said lack plate to swing toward said second position;

a lack pin holder for holding said lack pin;

a release button supported by said buckle body for pressing said holder to move said lack pin in said tongue plate insertion direction;

teeth provided on one of said cover and said buckle body; and

an inertial engaging member attached to said holder and having a mass portion, said inertial engaging member moving to engage said teeth when inertial force acts to move said inertial engaging member.

11. A buckle apparatus according to claim **10**, wherein said engaging member is a lever rotatably supported by a shaft at a side wall of said holder and having a mass portion and a claw portion disposed at opposing sides of the shaft.

12. A buckle apparatus according to claim **11**, wherein said claw portion of said lever is urged in a direction in which said claw portion engages said engaging teeth, said lever being prevented from rotating by said mass portion contacting a back portion of said release button so as to separate said claw portion from said teeth in a state where said holder is substantially in contact with said release button, and said mass portion being rotated and moved by inertial force to engage said claw portion with said teeth so as to prevent said holder from moving when inertial force acts in said tongue plate insertion direction.

13. A buckle apparatus according to claim **11**, wherein a helical spring is provided around said shaft of the lever so as to urge said claw portion of said lever in a direction away from said teeth.

14. A buckle apparatus according to claim **11**, wherein a coil spring is provided to couple said lever with said holder so as to urge said claw portion of said lever in a direction away from said teeth.

15. A buckle apparatus according to claim **10**, wherein said lock plate includes a U-shaped portion bent in a U-shaped configuration at an end of said lock plate on a tongue plate inserting side, a rising portion upward bent at the other end thereof, and a connecting portion for coupling said U-shaped portion and said rising portion, a distal end of said U-shaped portion serving as an engaging portion for engaging an engaging hole of said tongue plate, said lock pin being positioned on an intermediate portion of said U-shaped portion when said lock plate is held at said first position, and said lock pin being positioned on said connecting portion when said lock plate is held at said second position.

16. A buckle apparatus according to claim **10**, wherein said lock pin holder is urged by a spring to be in contact with said release button in a normal condition.

17. A buckle apparatus according to claim **10** further comprising an ejector disposed to be movable in tongue plate insertion and removal directions on said buckle body, said ejector being moved by said tongue plate when said tongue plate is inserted into said buckle body, and a distal end of said lock plate being at rest on an upper surface of said ejector when said tongue plate is being removed from said buckle body.

18. A buckle apparatus according to claim **10**, wherein said buckle body includes a flat plate portion, and a pair of leg plate portions opposed to each other with said flat plate portion interposed between said leg plate portions, said leg plate portions having horizontally elongated bearing holes for respectively supporting an end of said lock pin movably in tongue plate insertion and removal directions.

19. A buckle apparatus according to claim **10**, provided for use in seat belt systems.

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